LAWRENCE LIVERMORE REPORT

A weekly collection of scientific and technological achievements from Lawrence Livermore National Laboratory: Aug. 25-Sept. 2, 2008.

Compact radiotherapy system offers hope for cancer patients

An artist's rendering of the compact proton radiotherapy treatment concept.

The Laboratory-developed first compact proton therapy system -- one that would fit in any major cancer center and cost a fifth as much as a full-scale machine -- recently was featured on KGO-TV.

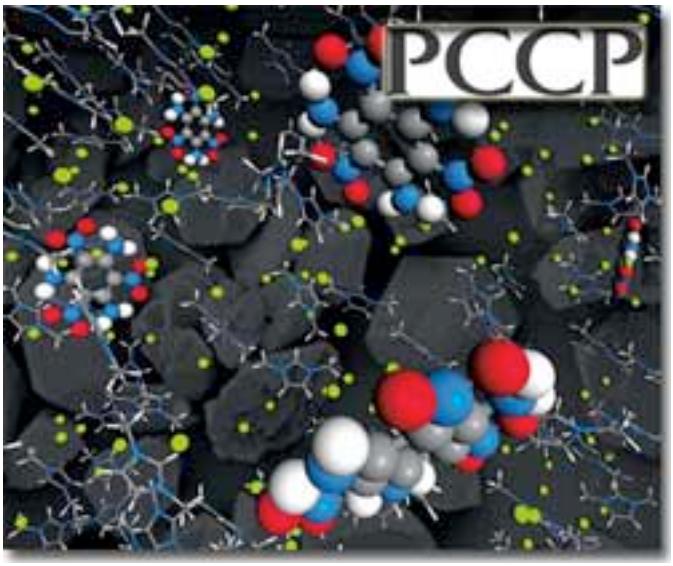
Proton therapy is considered the most advanced form of radiation therapy available, but size and cost have limited the technology's use to only six cancer centers nationwide.

The result of defense-related research, the compact system was developed by scientists at Lawrence Livermore in a project jointly funded by the Laboratory and UC Davis Cancer Center.

LLNL licensed the technology last year to TomoTherapy Incorporated of Madison, Wis. TomoTherapy will fund development of the first clinical prototype, which will be tested on patients at UC Davis Cancer Center. If clinical testing is successful, TomoTherapy will bring the machines to market.

For more information, go to
https://publicaffairs.llnl.gov/news/llnl_reports/kgotv_proton-therapy25aug20.mov

Explosives go 'green'



Fluoride ionic liquid works as a novel super-efficient solvent leading to high-quality single crystals of explosives.

Certain explosives may soon get a little greener and a little more precise.

LLNL researchers added unique green solvents (ionic liquids) to an explosive called TATB. This work, supported under the Transformational Materials Initiative (TMI) Laboratory Research and Development project, appears on the cover of the Sept. 1 issue of the journal *Physical Chemistry Chemical Physics.*

"Improving crystal quality and purity leads to explosive materials that are safer (less likely to react violently) when subjected to mechanical impact or heat," said Larry Fried, the project's principal investigator and a co-author of the paper.

To read more, go to
http://www.rsc.org/delivery/_ArticleLinking/DisplayHTMLArticleforfree.cfm?JournalCode=CP&Year=2008&ManuscriptID=b805169k&Iss=33

Building a better target for the world's biggest laser

In 2005, LLNL scientists Mordy Rosen and Jim Hammer predicted that a better-performing laser-heated hohlraum target – a key element in the National Ignition Facility's effort to achieve nuclear fusion – could be fashioned using low-density "foam" walls. Their analysis has now been verified by experimental results.

The hohlraum in a conventional indirect inertial confinement fusion (ICF) target, such as those used at NIF, is a gold cylindrical shell about the size of a pencil eraser that surrounds the target capsule. When irradiated by lasers, the hohlraum emits a "bath" of X-rays that heat and vaporize the outer layer of the capsule, causing it to rapidly implode. The resulting temperature and pressure force the hydrogen nuclei to fuse and "ignite" in a controlled fusion reaction.

The amount of X-ray radiation available depends on the initial conversion efficiency of laser light into primary X-rays and on the X-ray re-emission efficiency of the hohlraum walls. Improving the flux of X-rays that reach the capsule is important, because improvements in target performance mean increased operating margins for a given laser capability.

"More efficient hohlraums let us implode the same ignition target at lower laser powers and thus lower costs of 'wear and tear' on the laser," Rosen explains.

To read more, go to
http://scitation.aip.org/getpdf/servlet/GetPDFServlet?filetype=pdf&id=PRLTAO000101000003035001000001&idtype=cvips

Genome of simplest animal reveals ancient lineage

Trichoplax adhaerens

Appearances are deceiving -- even in life's tiniest critters. From first detection in the 1880s, clinging to the sides of an aquarium, to its recent characterization by the Department of Energy Joint Genome Institute, a simple and primitive animal, *Trichoplax adhaerens,* appears to harbor a far more complex suite of capabilities than meets the eye.

The findings, reported in the online edition of the journal *Nature*, establish a group of organisms as a branching point of animal evolution and identify sets of genes, or a "parts list," employed by organisms that have evolved along particular branches.

With each sequenced genome, another dataset is made available to advance the quest of evolutionary biologists seeking to reconstruct the tree of life. The analysis of the 98 million base pair genome of Trichoplax (literally "hairy-plate") illuminates its ancestral relationship to other animals.

The U.S. Department of Energy Joint Genome Institute, supported by the DOE Office of Science, unites the expertise of five national laboratories -- Lawrence Berkeley, Lawrence Livermore, Los Alamos, Oak Ridge, and Pacific Northwest -- along with the Stanford Human Genome Center.

To read more about the research, go to
http://www.jgi.doe.gov/News/news_8_21_08.html

Photo of the week

Biological analysis -- Ted Ognibene analyzes data from the NEC 1 MV tandem accelerator at the Lab's Center for Mass Spectrometry. The tandem accelerator is used for biological research such as tracing the path of vitamin absorption through the human body.

LLNL is managed by Lawrence Livermore National Security, LLC, for the U.S. Department of Energy's National Nuclear Security Administration.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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